Cause and Effect in the Growth of U.S. Cotton Yields

Agricultural Outlook Forum 2006

Seth Meyer Ph.D.
Cotton analyst
FAPRI
Food and Agricultural Policy Research Institute

Recent Cotton Policy Work at FAPRI

- **Step 2 Elimination**

  Summarized in both **Impacts of Commodity and Conservation Reserve Program Provisions in House and Senate Reconciliation Bills**

  FAPRI-UMC Report #15-05 and in:

- **Potential Impacts on U.S. Agriculture of the U.S. October 2005 WTO Proposal**

  FAPRI-UMC Report #16-05

  Analysis requested by Senator Saxby Chambliss of the Oct. 2005 U.S. WTO proposal.

- LEVELS MATTER

NASS
FACT FINDERS FOR AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D.C.

Crop Progress

Released June 9, 2003, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. For information on "Crop Progress" call Terry P. O'Connor at (202) 720-4288, office hours 7:00 a.m. to 4:00 p.m. ET.

Cotton: Crop Condition by Percent, Selected States

State	VP	P	F	G	EX
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
AL	3	18	28	46	5
AZ	0	3	37	48	12
AR	2	9	42	37	10
CA	0	0	30	50	20
GA	0	3	22	59	16
LA	3	7	35	51	4
MS	2	9	26	46	17
MO	6	11	39	41	3
NC	2	12	40	44	2
OK	0	4	62	31	3
SC	0	2	37	61	0
TN	5	16	37	41	1
TX	17	18	36	25	4
VA	1	13	33	53	0
14 Sts	8	12	34	39	7
Prev Wk	NA	NA	NA	NA	NA
Prev Yr	5	11	38	40	6

Reports start in the spring and conclude as harvest begins.

Planting Progress begins in late-March, Early April.

Crop condition reports begin early June, run through October.

Predictive Motivation

Corn Soybeans and Cotton

- Crop conditions summarize many factors, it is a quick (parsimonious) way of getting to a decent yield estimate.
  - Weather
  - Precipitation
  - Radiation
- First objective USDA estimate is in August and then only monthly while crop condition reports are available weekly through to harvest (end of October).
- Easy

Baseline/Policy Motivation

- Use crop conditions to discover underlying yield trends.
- Yield ‘step off’ and expected growth impact expected producer returns, acreage mix and program cost estimates.
- In both the Step 2 and WTO analysis, price levels matter (and therefore so do yields).

Structure of Yield Equations

- Yield = a
  - $+B_1(\%poor)$
  - $+B_2(\%fair)$
  - $+B_3(\%good)$
  - $+B_4(\%excellent)$
  - $+B_5(Trend)$
  - $+B_6Log(Planting\ Progress)$
- Parameter estimates B_1 through B_4 are changes to “base” yields from each category.
- Intuition is increasing in B
- Non-Linear in planting progress

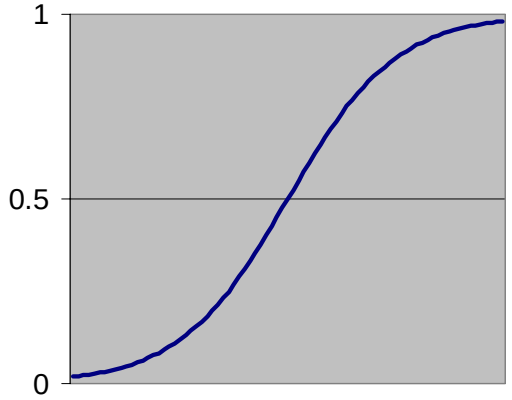
Structure of Yield Equations
Problems with Previous techniques

- When estimating harvested yields many cotton equations would put a higher yield on very poor than poor.
- Why? Abandonment. As portions of the crop move from the poor category to the very poor category, the “harvested” yield may go up as that portion of the crop is less likely to be harvested.
- Need planted area yield and abandonment.

Abandonment Equation

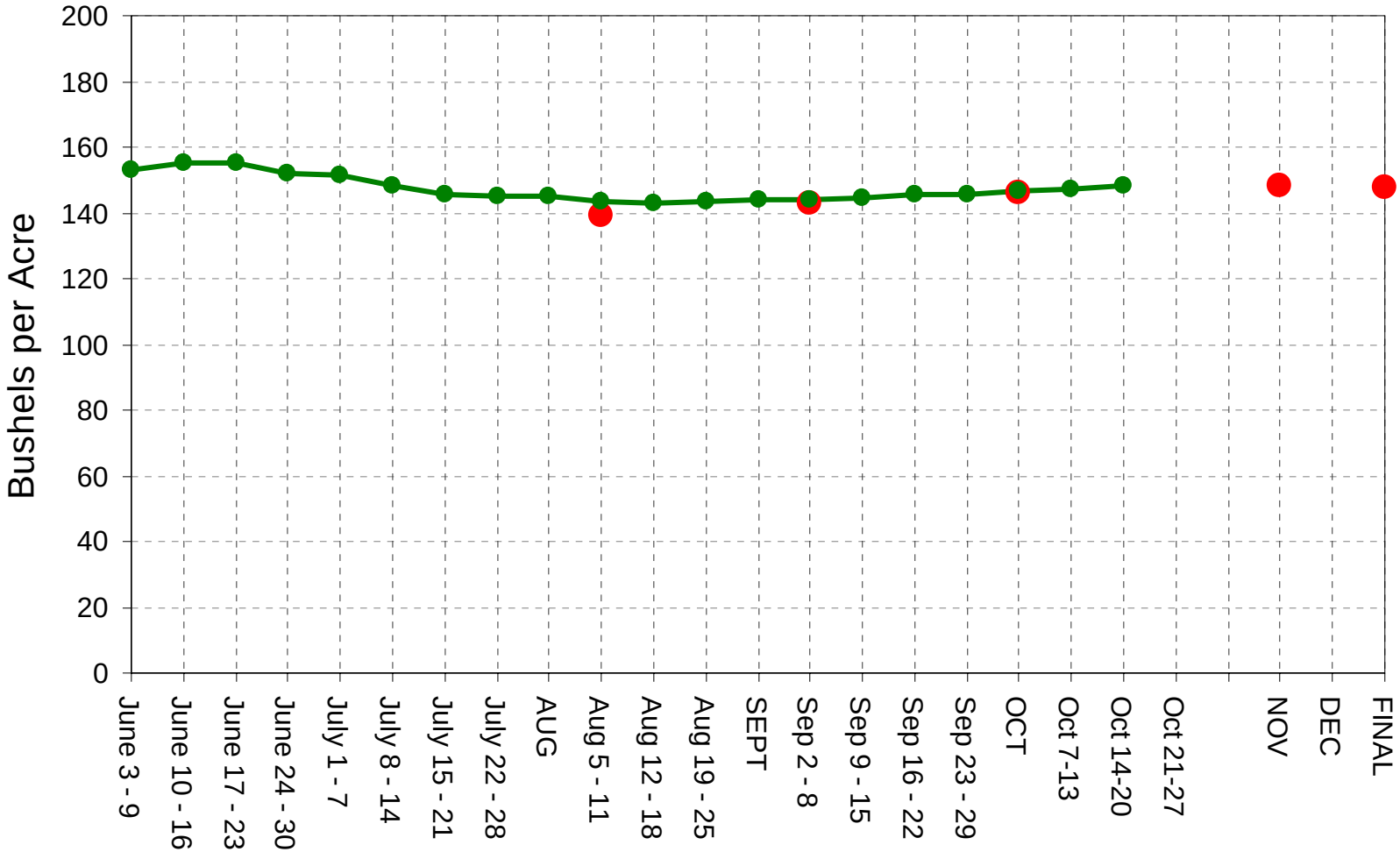
- Abandonment (X) is estimated as:

$$\ln\left(\frac{X}{1-X}\right)$$

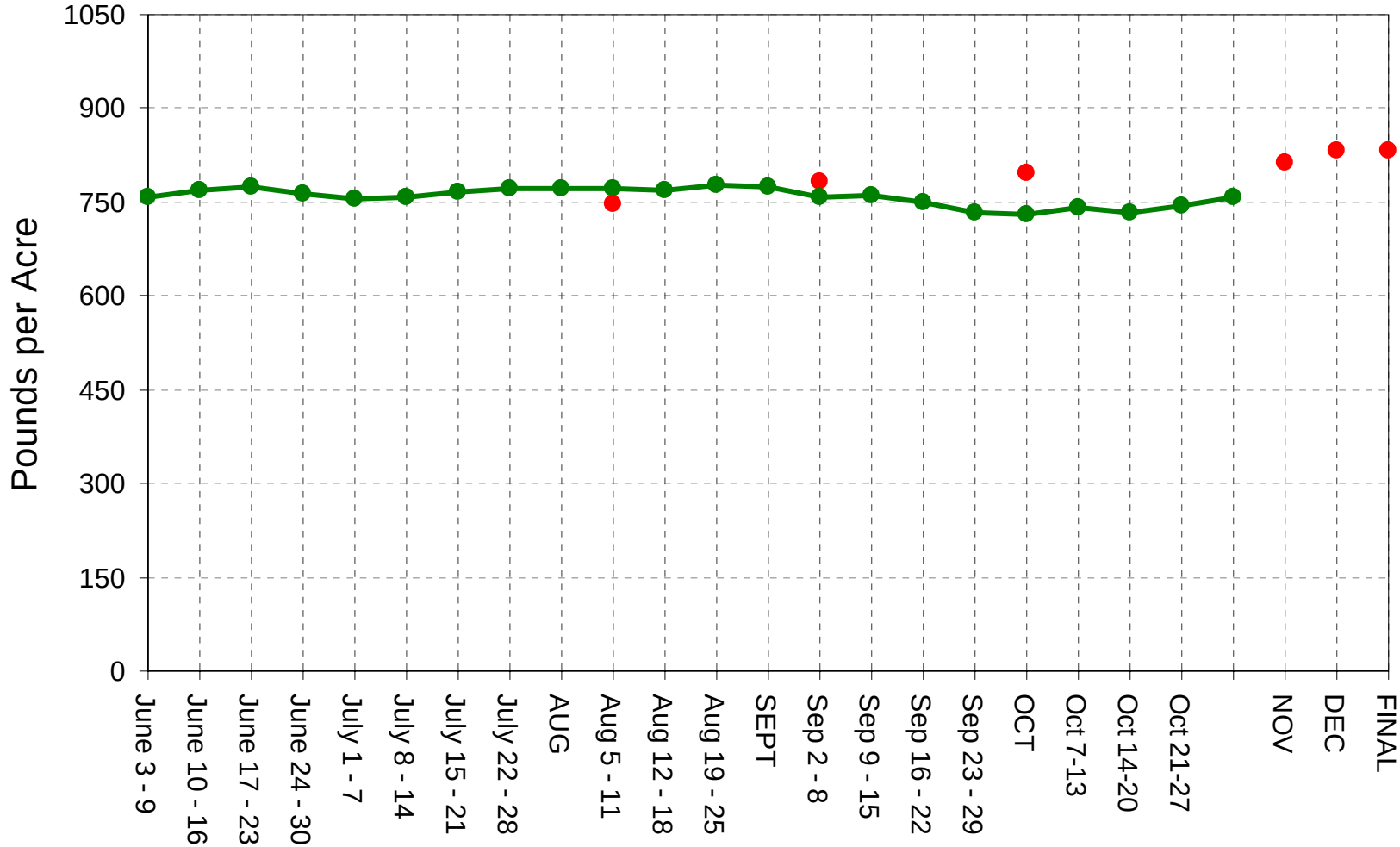


- This bounds the abandonment rate to be between 0% and 100%

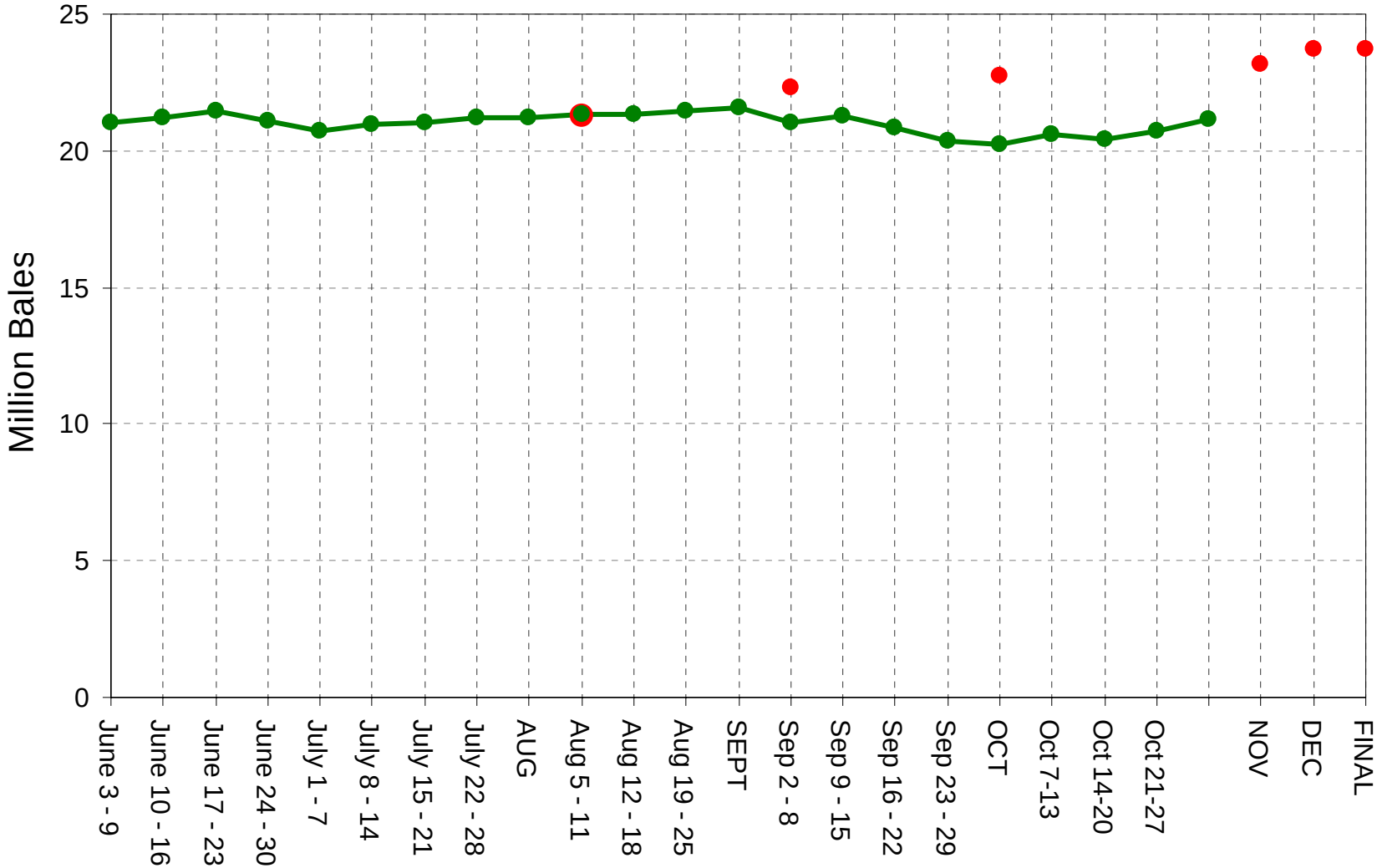
United States Corn Harvested Area Yield Est. - 2005



U.S Cotton Harvested Area Yield Est.- 2005

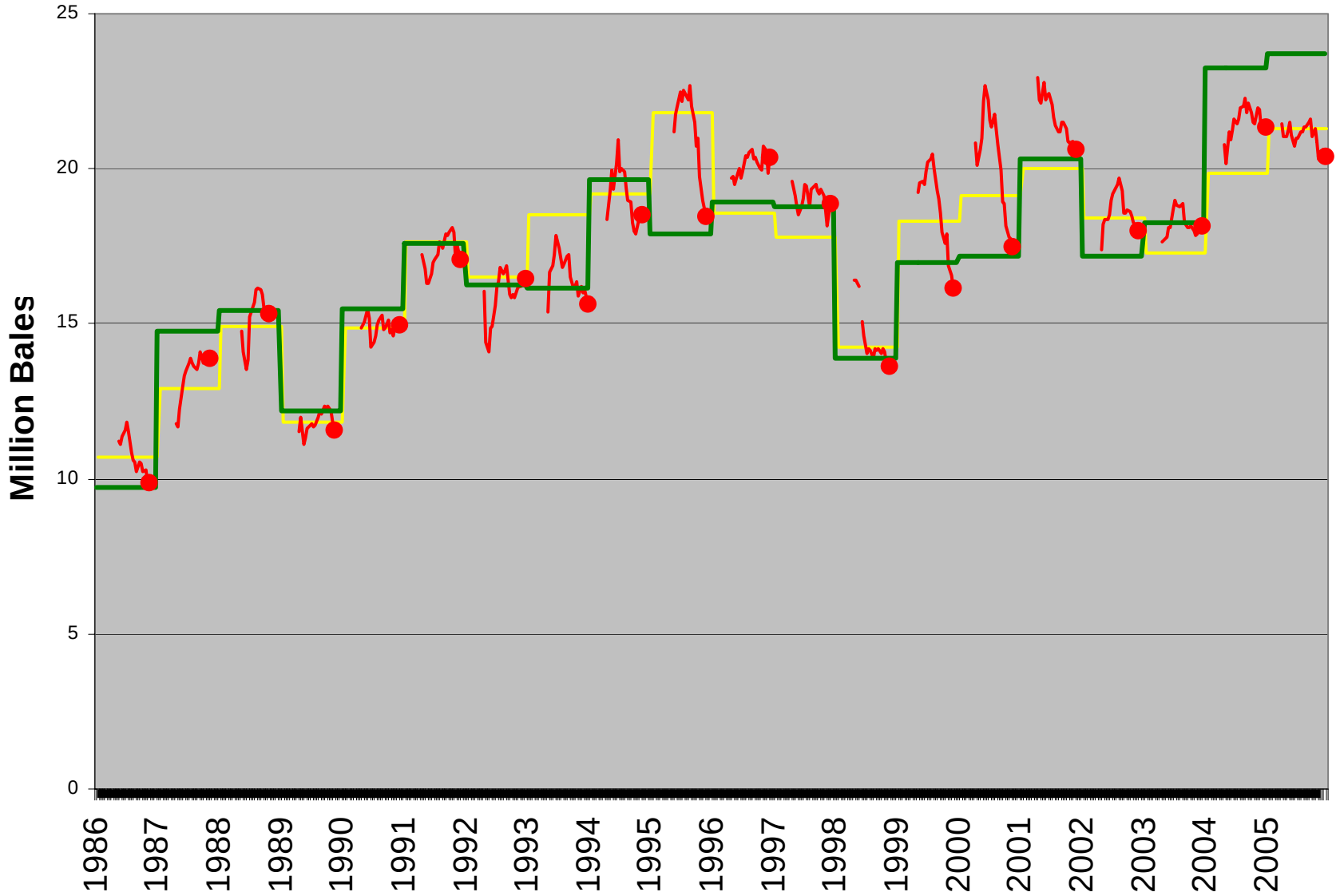


United States Cotton Production Estimate - 2005



US Cotton Production Estimates

USDA August – and Final – vs. Crop Condition Estimate –



US yield trends

		2005	2006	2010	Annual Growth Rate
Trend	1986-2003	682.3	687.6	709.0	0.8%
	1986-2004	720.8	729.0	762.0	1.1%
CC Trend	1986-2003	714.1	703.1	730.1	0.9%
	1986-2004	752.7	738.5	775.7	1.2%

January 06 USDA est. 831

New Varieties? 2002 to 2005

	Percent	
OK	2005	2002
PM 2280 BG/RR	16.0	4.8
DP 444 BG/RR	13.6	0.0
ST 4892 BR	12.3	16.0
FM 960BR	11.0	0.0
DP 555 BG/RR	7.7	0.0
	60.7	**20.7**

	Percent	
LA	2005	2002
DP 555 BG/RR	62.4	1.6
ST 5599 BR	11.5	0.0
DP 444 BG/RR	8.8	0.0
DP 449 BG/RR	3.6	0.0
FM 960BR	2.7	0.0
	89.0	**1.6**

NC	2005	2002
DP 444 BG/RR	23.9	0.0
DP 555 BG/RR	14.6	1.1
DP 451 B/RR	11.9	25.9
DP 449 BG/RR	8.2	0.0
ST 5599 BR	7.1	0.0
	65.8	**27.0**

MS	2005	2002
DP 555 BG/RR	30.9	0.9
ST 5599 BR	25.3	0.0
DP 444 BG/RR	15.4	0.0
ST 5242 BR	7.2	0.0
DP 434 RR	3.2	0.0
	82.0	**0.9**

SC	2005	2002
DP 555 BG/RR	57.3	0.0
DP 565	6.0	0.0
ST 5599 BR	5.5	0.0
DP 444 BG/RR	4.6	0.0
DP 488 BG/RR	3.1	0.0
	76.6	**0.0**

GA	2005	2002
DP 555 BG/RR	72.8	0.3
DP 444 BG/RR	3.4	0.0
DP 5690 RR	2.4	12.4
DP 449 BG/RR	1.8	0.0
FM 960BR	1.6	0.0
	82.0	**12.7**

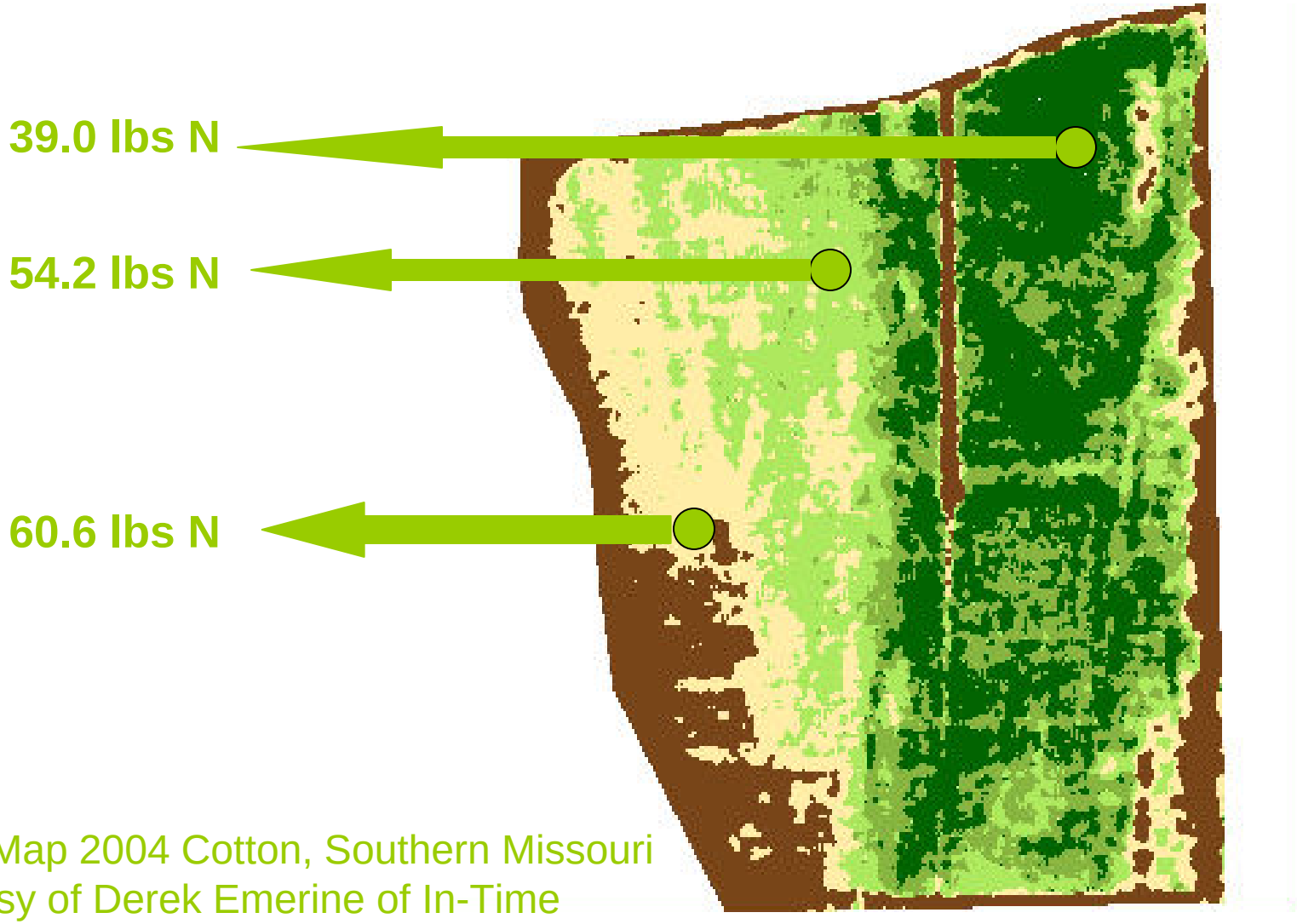
Source: USDA-AMS cotton program, Memphis TN

Boll weevil eradication

- Boll weevil eradication program doesn't explain recent 'jump' in yields for 2004 and 2005 (maybe Texas)
  - Eradication in NC, SC, VA, mid-TN an South AL achieved by 1996
  - Texas beginning programs to eliminate last remaining regions
  - Has boll weevil eradication acreage response contributed to a suppressed aggregate yield growth over the 1987 to 1997 period? 1987 eradication program begins in GA, cotton acreage at 275,000. Cotton acreage reaches 1.5 million acres by the time eradication is reached in 1995.

Changes in Management Practices

variable rate application encouraged by increasing costs

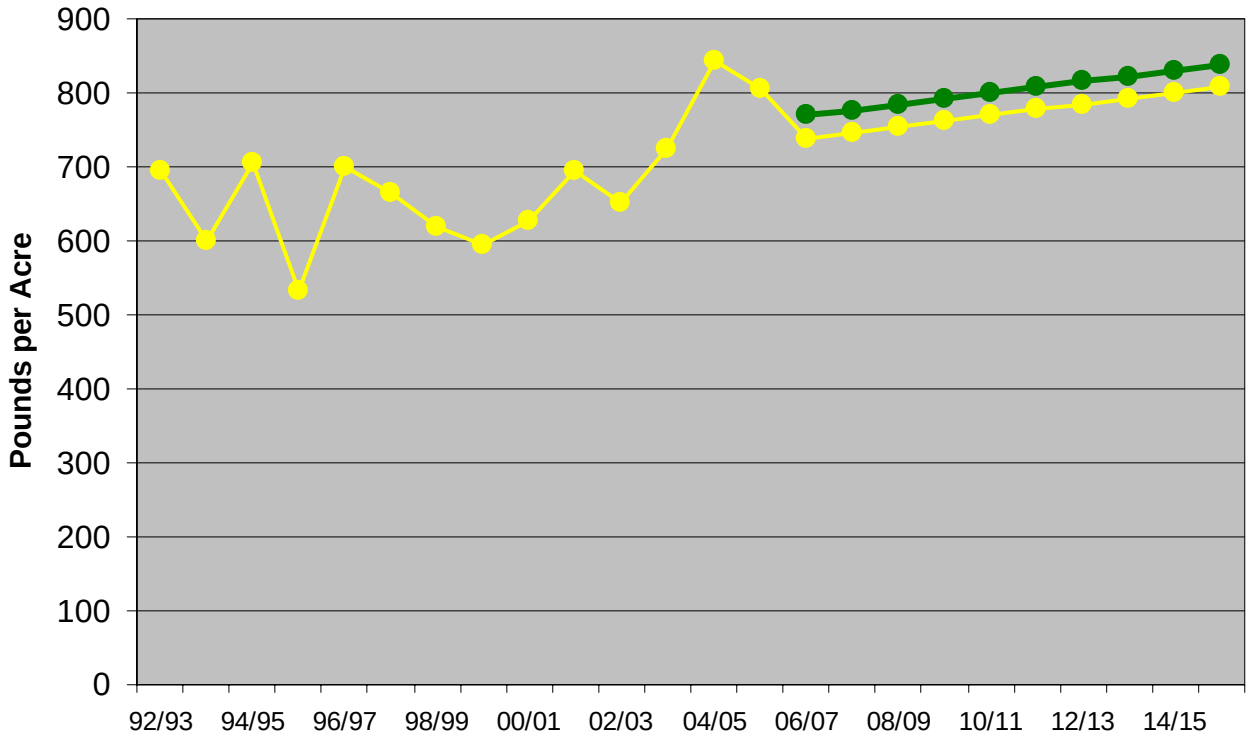


Scout Map 2004 Cotton, Southern Missouri
Courtesy of Derek Emerine of In-Time

Other possibilities

- Doesn't include information on *harvest* weather
  - Big impact on final yields
  - Abandonment in Texas
- Physiology adds to uncertainty
  - Perennial with indeterminate growth habits
  - Highly responsive to management and environment
- Bad data
  - Data *is* subjective
  - Southeastern Extension agents more pessimistic?
- Changes in management practices
  - Variable Rate Application
  - Conservation or strip tillage

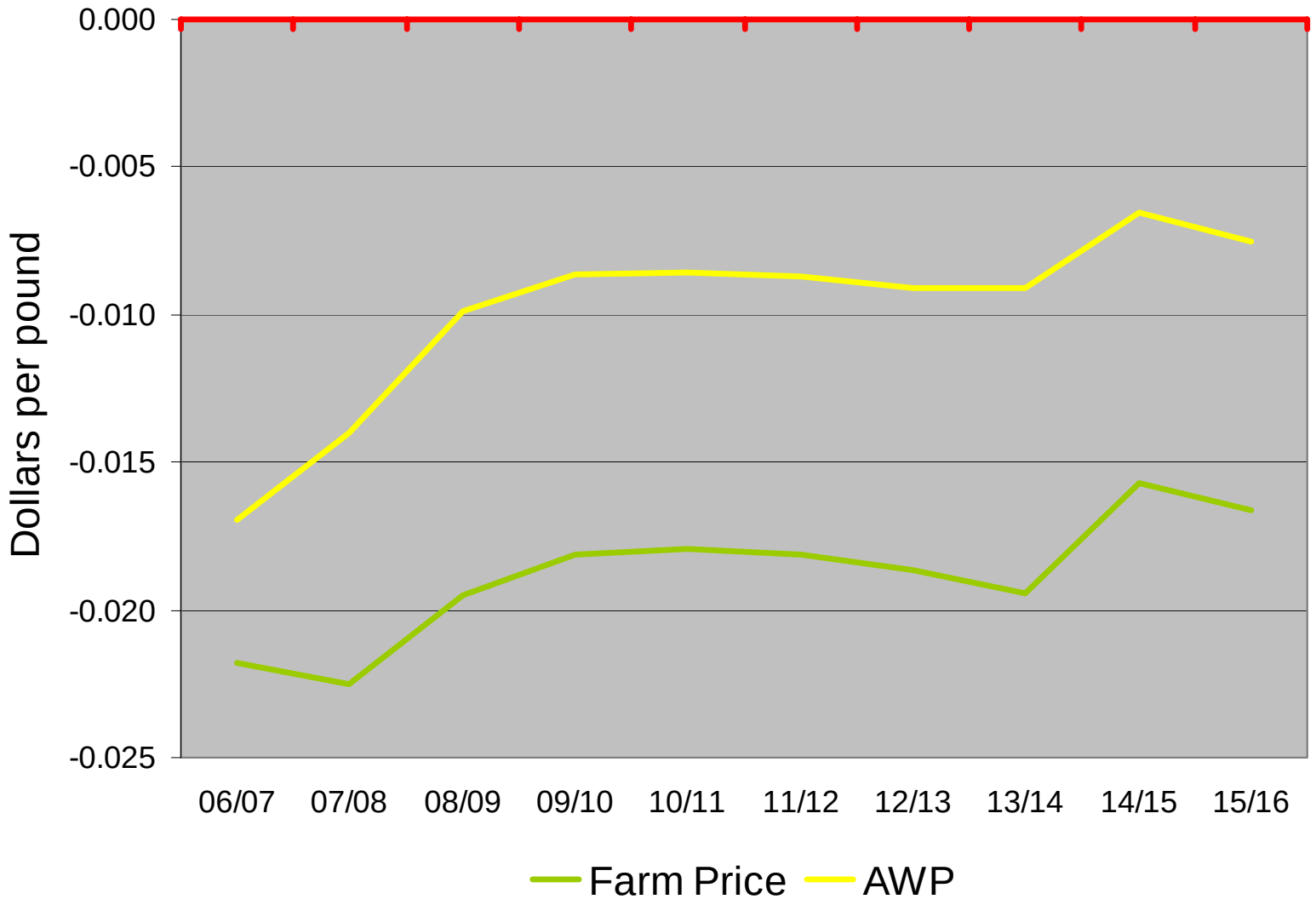
Yields: Quantifying the yield “step”



Corn Belt	+30lbs
Central Plains	+27lbs
Delta States	+50lbs*
Far West	+ 0lbs
South East	+38lbs
Southern Plains	+15lbs

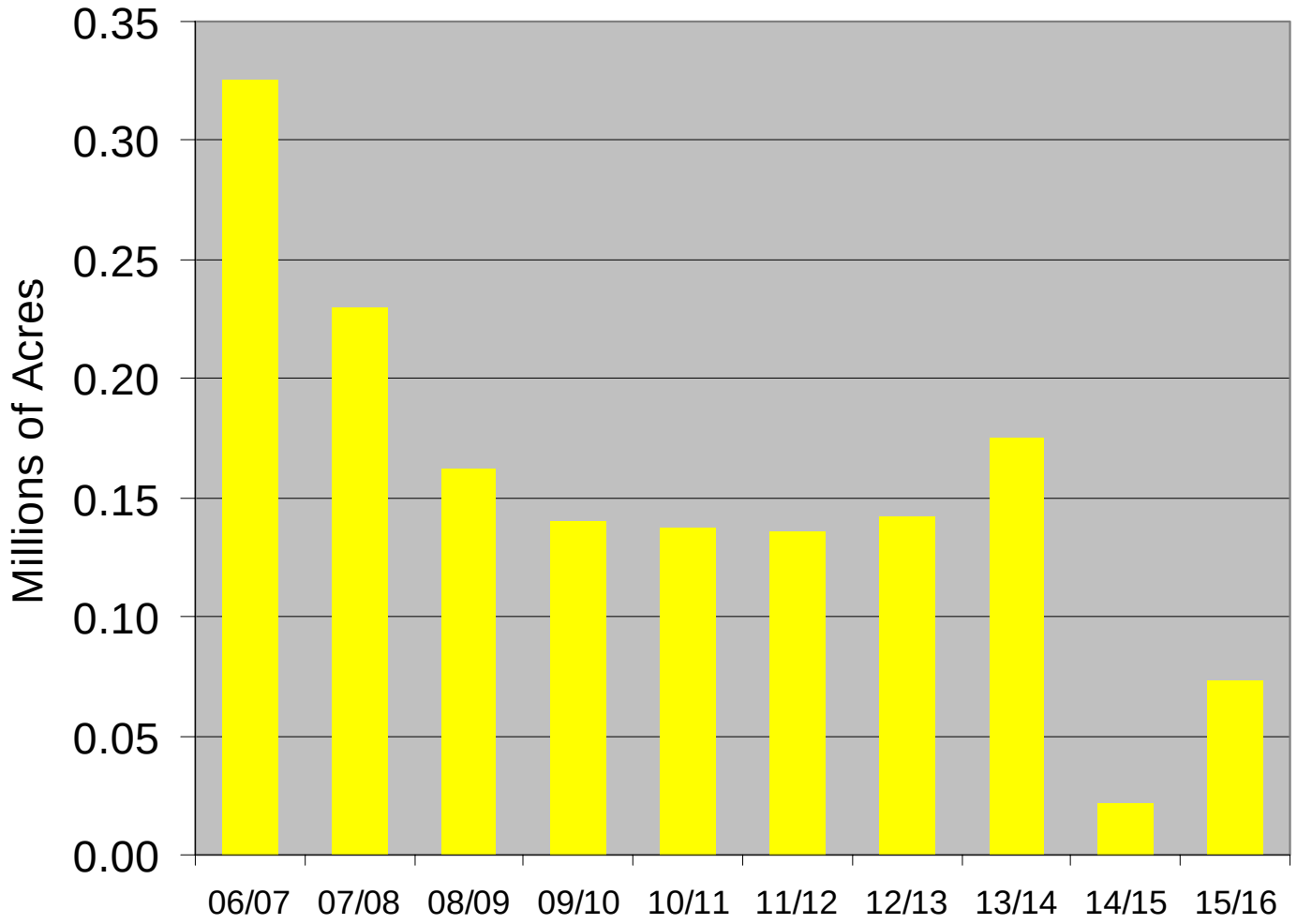
Change in Prices

prices decline and area increases



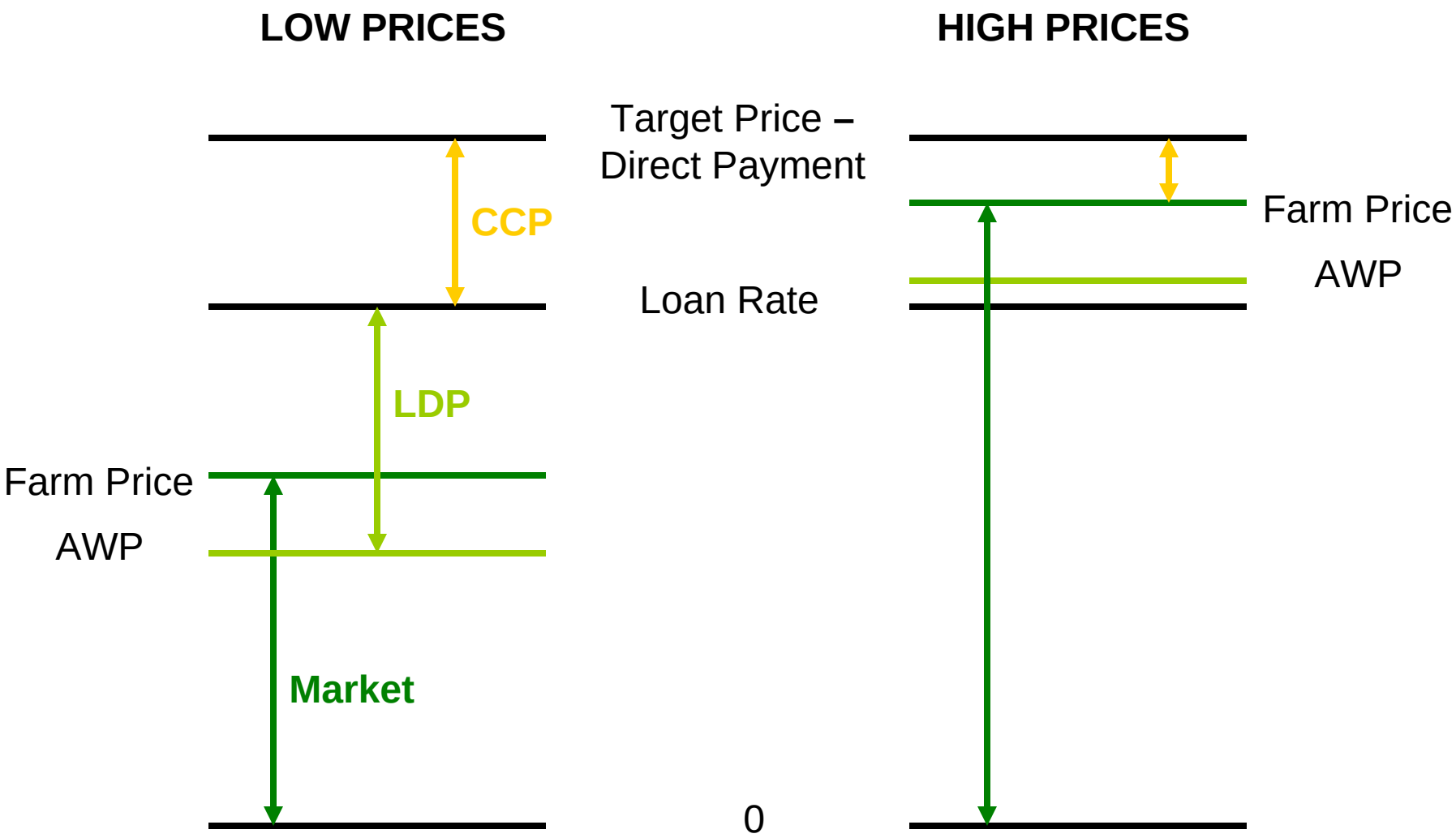
Change in Planted Area

prices down but area up? Not market driven



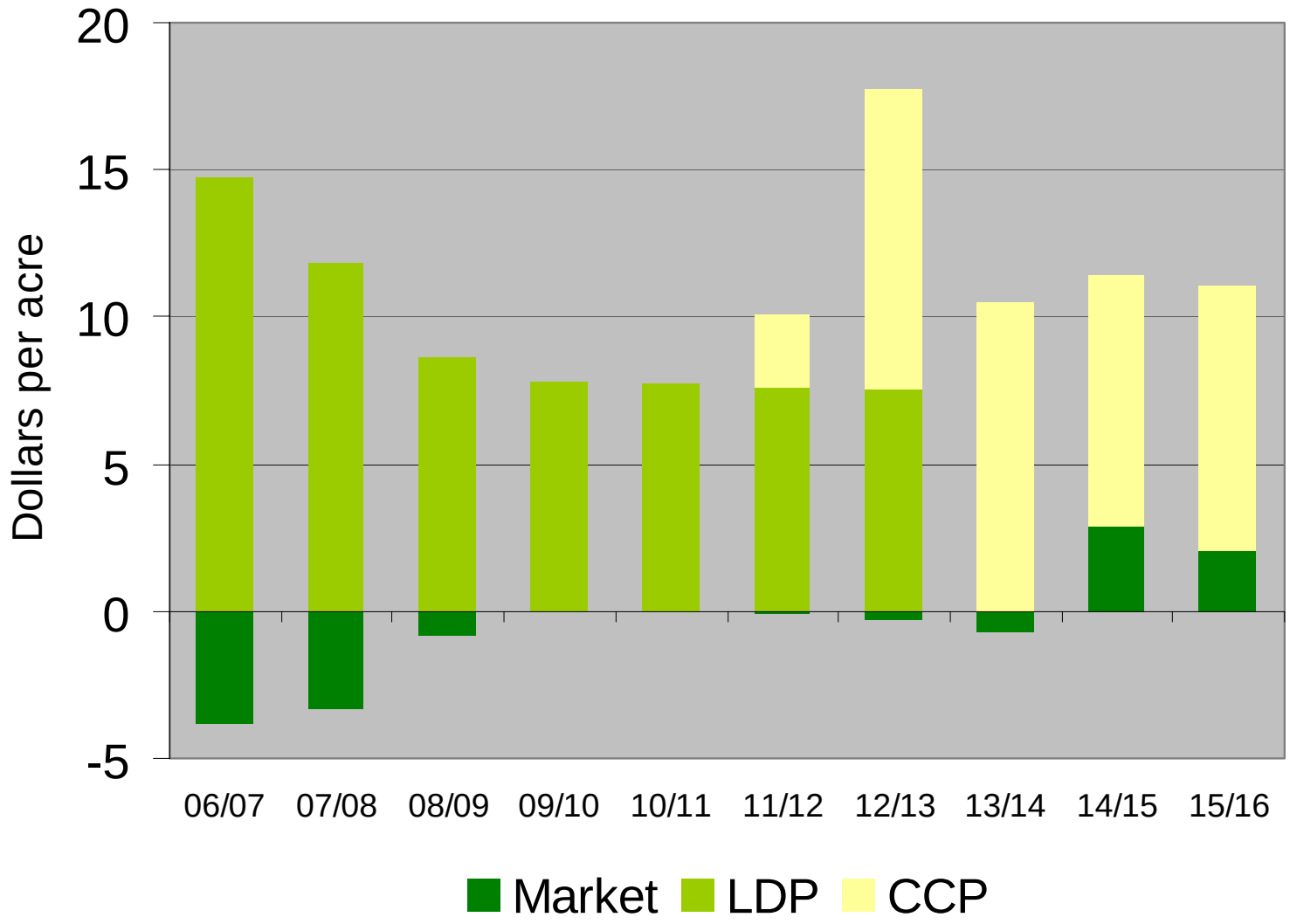
Program Parameters

Levels matter

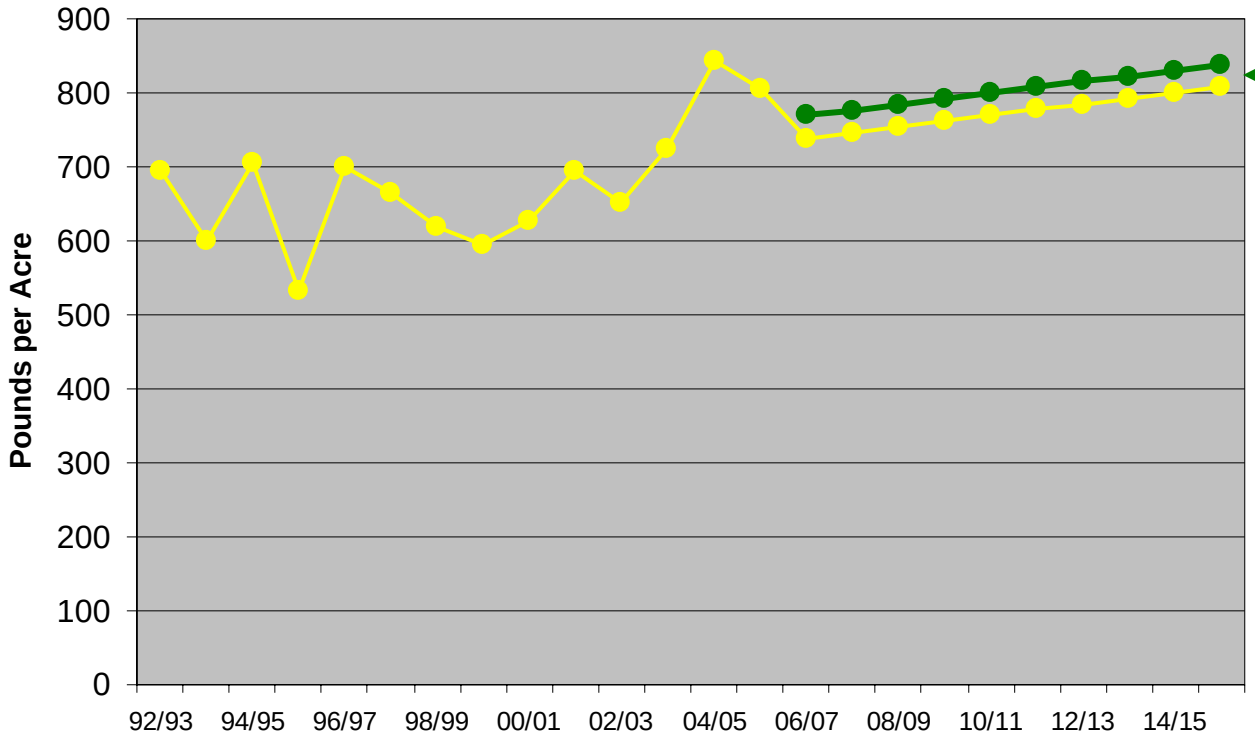


Changes in per acre cotton revenue

with yield anticipated step-up



Yields: Quantifying the yield “step”



$1.8 Billion of additional government costs for cotton.

Total government expenditures up some lesser amount. Cotton programs more expensive, total acreage up ~ 50,000 acres a year.

MeyerSe@missouri.edu

Food and Agricultural Policy Research Institute
University of Missouri
www.fapri.missouri.edu